Quantum information processes in protein microtubules of brain neurons for altered states of consciousness and insightful creativity

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# 1 Introduction

All living cells of plants, animals and humans continuously emit ultraweak biophotons (ultraweak electromagnetic waves) in the optical range of the spectrum, which is associated with their physiological states and can be measured using special equipment. Neural cells also continuously emit biophotons. The intensity of biophotons is in direct correlation with neural activity, cerebral energy metabolism, EEG activity, cerebral blood flow and oxidative processes [1, 2]. According to Van Wijk et al [3], there are significant correlations between the fluctuations in biophoton emission and fluctuations in the strength of electrical alpha wave production in the brain. Some unpublished observations suggest that the state of the biophoton field of a person may be connected to the state of the brain as measured by the EEG (e.g., degree of synchronization and coherence) [4]. Certain meditative states characterized by a high degree of coherence in the EEG may well be accompanied by a high degree of coherence in the biophoton field [4], although measurements correlating the coherence of the biophoton field and the EEG readings have not been made yet. In this situation it is very important to study the interaction of biomolecules with biophotons of brain neurons and to quantitatively investigate possible connections between the EEG and the biophoton production.

There is no doubt that EEG waves are deeply involved with the basic functioning of the brain. The EEG waves associated with two distant neurons are strongly correlated and this supports the view that EEG waves are related to the properties of the brain as a coherent quantum system.

In modern optogenetics much attention is devoted to the possibility to manipulate neurons with light [5], [6], [7]. In this situation spatially-precise neuronal control and monitor the activities of individual brain neurons are realized with the help of optogenetic actuators (channelrhodopsin, halorhodopsin, archaerhodopsin) and temporally-precise recordings can be made with the help of optogenetic sensors for calcium (Aequorin, Cameleon, GCaMP), chloride (Clomeleon) or membrane voltage (Mermaid).

At present much attention is devoted to the nature of consciousness and mechanism by which it occurs in the brain [8]. In this situation consciousness depends on biologically "orchestrated" coherent quantum processes in collec-

tions of microtubules (MTs) within brain neurons [9]. It is very important to unify micro and macro levels: quantum-statistical properties of quantized fields insight MTs and EEG signals [10], because superradiant optical computing in networks of microtubules may provide a basis for biomolecular cognition and a substrate for consciousness [11], fMRI and SPECT (single-photon emission computed tomography) are also very important tools for investigation of cooperative processes in protein microtubules of brain neurons. There has been a strong recent interest in applying quantum theory in cognitive science [12]. It should be noted that special evaluation of altered states of consciousness (ASC), induction of ASC by different physical methods: electrical stimulation (direct and alternating current), magnetic stimulation, sound (binaural) stimulation compared with placebo in healthy volunteers will give more insight about nature of consciousness from quantum biophysical point of view [13, 14].

## 2 Fluctuation function of protein microtubules

At present much attention is paid to the coupling between fluctuation function $S_z(t)$ of protein MTs and EEG signal, influence of coherence in biophoton field (Fig. 1) on coherence in neuronal system and correlations between the fluctuations in biophoton emission and fluctuations in the strength of electrical alpha wave production in the brain.
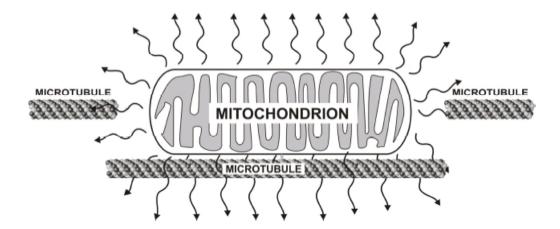
Fig. 1 Representation of biophotons produced by mitochondria and the interaction of biophotons with microtubules



Fig. 2 MTs are hollow cylinders composed of protein units called tubulin. The inner diameter of an MT is 17 nm and the outer diameter is 25 nm. The lengths of MTs vary widely from nanometers to micrometers. MTs have been considered to act as QED-cavities [16, 17].

It should be emphasized that MTs have been considered as optical cavities (Fig. 2) [16] with quantum properties [17], capable of supporting only a single mode [18] or perhaps a few widely spaced (in the frequency domain) modes.

Rahnama et al [10] is successfully applied a fully quantum mechanical formalism of the Jaynes-Cummings model (JCM) [19], [20, 21] for the description of quantum dynamics of protein microtubules of brain neurons. It is noticed that MTs are biological hollow cylinders with a 17 nm inner diameter and a 25 nm outer diameter (Fig. 2) [22], composed of units called tubulin dimers, each of which has the dimensions $4nm \times 8nm \times 6nm$ [16]. Tubulin can be viewed as a typical two-state quantum mechanical system, where the dimers couple to conformational changes with $10^{-9} - 10^{-11}$ sec transitions due to electron transitions in hydrophobic pockets, corresponding to an angular frequency in the range $\omega_0 \sim O(10^{10}) - O(10^{12})$ Hz [16]. Using a first-order-approximation estimate of the quality factor for the MT cavities (i.e. $Q_{MT}$), it has been found that $Q_{MT} \sim O(10^8)$ [16]. High-quality cavities encountered in Rydberg atom experiments dissipate energy on time

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scales of $O(10^{-3}) - O(10^{-4})$ sec and have quality factors which are comparable to $Q_{MT}$ [16]. Frequencies of visible light are on the order of THz and Wang et al [23] have detected visible light in the brain as biophotons. Also, transition frequencies in tubulins are on the order of THz [16]. In order to get more physical insight about Quantum Brain Dynamics it is necessary to carefully examine properties of a single protein microtubule [24] from quantum-mechanical point of view. This will give new possibilities for realization and manipulation of quantum information processes with the help of entanglement and non-local canals in the ensemble of microtubules of brain neurons (Fig. 3).
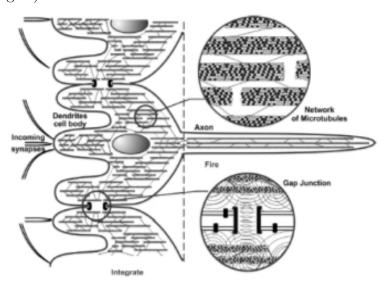


Fig. 3 An "integrate-and-fire" brain neuron, and portions of other such neurons are shown schematically with internal microtubules. In dendrites and cell body/soma (left) involved in integration, microtubules are interrupted and of mixed polarity, interconnected by microtubule-associated proteins (MAPs) in recursive networks (upper circle, right). Dendritic-somatic integration (with contribution from microtubule processes) can trigger axonal firings to the next synapse. Microtubules in axons are unipolar and continuous. Gap junctions synchronize dendritic membranes, and may enable entanglement and collective integration among microtubules in adjacent neurons (lower circle right). In Orch OR, microtubule quantum computations occur during dendritic/somatic integration, and the selected results regulate axonal firings which control behavior.

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Let us investigate quantum brain dynamics and analyze fluctuation function of MTs in the case, in which MT has three energy states: ground state $|g\rangle$, first excited $|e_1\rangle$ and second excited $|e_2\rangle$ biomolecular states. In this situation it is assumed that at the initial moment t = 0 MT is situated in the first excited state and quantized electromagnetic field in Holstein-Primakoff SU(1,1) coherent state [19, 20]

$$|\psi(0)\rangle_{biophotons} = (1 - |\xi|^2)^k \sum_{m=0}^{\infty} \left\{ \frac{\Gamma(m + 2k)}{m!\Gamma(m + 2k)} \right\} \xi^m |m, k\rangle, \qquad (1)$$

where $|m, k\rangle$ are the eigenvectors of the Casimir operator

$$C = K_0^2 - \frac{K_+K_- + K_-K_+}{2} = k(k - 1)I \qquad (2)$$

k is the so-called Bargmann index and $\xi = |\xi| \exp(i\phi)$ ($0 \leq \xi \leq 1$). In the present model $k = 1/2$ and SU(1,1) CS can be written through oscillator number states

$$|\psi(0)\rangle_{biophotons} = (1 - |\xi|^2)^{1/2} \sum_{n=0}^{\infty} \xi^n |n\rangle = \sum_{n=0}^{\infty} Q_n |n\rangle. \qquad (3)$$

In this case the initial state - vector of the coupled MT - field system takes the following form

$$|\psi(t = 0)\rangle = |\xi\rangle \otimes |e_1\rangle = \sum_{n=0}^{\infty} Q_n |e_1, n\rangle \qquad (4)$$

Exact analytical solution for state-vector of the MT - field system can be obtained by using Schrodinger equation:

$$
\begin{aligned}
|\psi(t)\rangle = & \sum_{n=0}^{\infty} e^{-i\omega_0(S_z+n)t} Q_n \{ cos\left( \sqrt{n^2 + \alpha^2(n+1)^2} \tau \right) |e_1, n\rangle \\
& - \frac{i\alpha(n+1)}{\sqrt{n^2 + \alpha^2(n+1)^2}} sin\left( \sqrt{n^2 + \alpha^2(n+1)^2} \tau \right) |g, n+1\rangle \\
& + \frac{in}{\sqrt{n^2 + \alpha^2(n+1)^2}} sin\left( \sqrt{n^2 + \alpha^2(n+1)^2} \tau \right) |e_2, n-1\rangle \}
\end{aligned}
\qquad (5)
$$

where dimensionless time is $\tau = \lambda_1 t$, $\alpha = \lambda_2/\lambda_1$, $\lambda_1$ and $\lambda_2$ are MT - field coupling constants [10]. By using solution (5) one can obtain exact analytical

solution for fluctuation function $S_z(t)$ in the following manner

$$S_z(t) = -(1 - |\xi|^2) \sum_{n=0}^{\infty} (|\xi|^2)^n sin\left(\sqrt{n^2 + \alpha^2(n+1)^2}\tau\right) \frac{n^2 - \alpha^2(n+1)^2}{n^2 + \alpha^2(n+1)^2} \quad (6)$$

In figure 4 we show $S_z(t)$ as a function of time for cases $|\xi| = 0.6$ and 0.9, $\alpha = 0.1$ and 0.01. In this situation it is observed that the higher the initial mean biophoton number $n(t = 0) = |\xi|^2/(1 - |\xi|^2)$, the higher $S_z(t)$. There are also some jumps in the fluctuation function, in which a strong energy exchange between the MTs and field subsystems takes place.
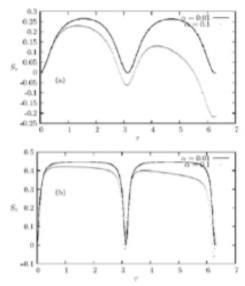


Fig. 4 $S_z(t)$ as a function of the dimensionless time $\tau$ for cases $\alpha = 0.1$ and 0.01: (a) $|\xi| = 0.6$, (b) $|\xi| = 0.9$.

It is very important to investigate the generation of squeezed states of quantized electromagnetic field insight protein MTs for ultrafast biooptical communication because squeezed light has been observed in living tissues [15]. By use of coincidence measurements on "ultraweak" photon emission, the photocount statistics (PCS) of artificial visible light turns out to follow as expected super-Poissonian PCS. Biophotons, originating from spontaneous or light-induced living systems, display super-Poissonian, Poissonian and even sub-Poissonian PCS. This result shows the first time evidence of non-classical (squeezed) light in living tissues [15]. In figure 5 we present function $S_1$, describing squeezed biophoton states in protein MTs (squeezing takes place when $-1 \leq S_1 \leq 0$)
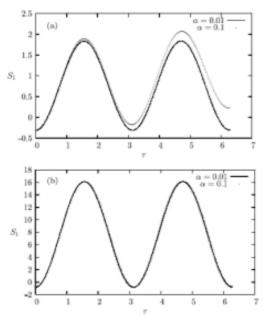
Fig. 5 Generation of squeezed states of quantized electromagnetic field in mictotubule $S_1(t)$ for cases $\alpha = 0.1$ and 0.01: (a) $|\xi| = 0.6$, (b) $|\xi| = 0.9$.

It should be noted that present JCM with intensity-dependent coupling [19], [20] in the best way describes quantum vibrations of MTs of brain neurons and gives more insight about faster microtubule vibrations as a possible source of the observed EEG correlates of consciousness from quantum biophysical point of view.

# 3 Quantum entanglement and non-local models of quantum information processes in microtubules of brain neurons

Quantum entanglement is, according to Erwin Schrodinger in 1935, the essence of quantum physics and inspires fundamental questions about the principles of nature. By testing the entanglement of particles we are able to ask fundamental questions about realism and locality in nature. Local realism imposes certain constraints in statistical correlations of measurements on multi-particle systems. Quantum mechanics, however, predicts that entangled systems have much stronger than classical correlations that are independent of the distance between the particles and are not explicable with classical physics.

In non-local models of quantum mechanics quantum system behaves as a whole no matter how far separated its components. In other words, correlations between electrons or photons, composing the whole quantum system exist at distances much larger than the dimensions of composed parts. It should be noted that experimental demonstration of quantum correlations over more than 10 km was realized by Tittel et al [25]. Moreover, quantum entanglement distribution over 100-kilometre free-space channels is successfully demonstrated by Yin et al [26]. It should be emphasized that quantum entanglement takes place also in living species, in which biophotons are generated by mitochondria [10]. In this situation each living cell is giving off, or resonating, a biophoton field of coherent energy. If each cell is emitting this field, then the whole living system is, in effect, a resonating field - a ubiquitous nonlocal field. And since biophotons are the entities through which the living system communicates, there is near-instantaneous intercommunication throughout, which is the basis for coherent biological organization - referred to as quantum coherence. In this case much attention is devoted to the timeless approaches and quantum vacuum [27, 28]. Capacity for evolution rests not on aggressive struggle and rivalry but on the capacity for communication and cooperation. In this sense the built-in capacity for species evolution is not based on the individual but rather living systems that are interlinked within a coherent whole: Living systems are thus neither the subjects alone, nor objects isolated, but both subjects and objects in a mutually communicating universe of meaning. Experiments with non-local signal transfer between seeds, plant organisms and bio-hybrid systems confirm this point [29, 30], [31, 32]. Just as the cells in an organism take on different tasks for the whole, different populations enfold information not only for themselves, but for all other organisms, expanding the consciousness of the whole, while at the same time becoming more and more aware of this collective consciousness.

Because protein microtubules of brain neurons are quantum optical devices [9, 10], [11], [16, 17] it is instructive to study the generation of squeezing and entanglement in microtubules to obtain more insight about nature of consciousness from quantum biophysical point of view. In this situation non-local correlations takes place between different microtubules of brain neurons and therefore quantum information in the brain may be transmitted through non-local canals `https://www.youtube.com/watch?v=0fu_k8_tae0`.

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# 4 Altered states of consciousness and insightful creativity

The study of the phenomenon of consciousness seems to be more heuristic not only in one form of "ordinary consciousness" but, especially, in other many versions as altered states of consciousness (ASC). It is known that consciousness changes may be spontaneous (sleep, dreams) or pathological (coma). Various induced ASC (meditation, hypnosis, and other forms of trance) by different physiological and/or psychological methods and techniques and using various substances (substances for general anesthesia, antidepressants, opioids, etc.) have an advantage in terms of experimental research of ASC, but also in terms of bioethics approach.

Altered states of consciousness probably could be understood as a more "old", archaic version of consciousness and assume hypothetically possible functioning at a level of where there may be some archaic elements of "proto-consciousness" in the studied subject. In ASC arise exceptional opportunities of human beings (abolition of pain, increase physical and mental performance, certain insights, etc.) that can be explained by a "reset" of special neurodynamic and psychophysiological processes [13, 33]. Using the advanced evaluation methods (fMRI, PET, EEG, etc) with special "quantum interpretation" could be a real point of insight in this research.

The study of consciousness - central research phenomenon of the project required analysis of this subjective phenomenon itself, which is consciousness. Consciousness, being a subjective reality, can be studied now parallel with quantum reality.

Assessment of subjective phenomenological structure of consciousness and especially in ASC using the methods already well developed and validated [34, 35] seems to be an imperious necessity in this context.

We already have some experience of phenomenological analysis of ASC induced by hyperventilation, hyperventilation combination with some special music (holotropic breathing), binaural stimulation and transcranial direct current stimulation (by placing electrodes in certain eloquent areas) in healthy subjects [13, 14].

The concept of this experiment is starting from model of analysis of the anesthesia phenomenon in the publication by Hameroff and Penrose "Consciousness in the universe, a review of the Orch OR theory" [9]. It is known that the aim of anesthesia is to abolish pain, but this phenomenon occurs

simultaneously with the abolition of consciousness. These phenomena (consciousness and pain) are closely linked. The mechanism of anesthesia is to disperse dipole (electric or magnetic) of microtubules required for consciousness phenomenon that the same time can completely stopped pain.

So the phenomenon of consciousness and pain abolition was induced using a chemical factor (anesthetic). Continuing the same logic of research, in experiment proposed by us action factors (which will change consciousness) are of different origin - the physical origin. The experiment provided for inclusion in this project aims to foster opportunities of interpretation in the logical framework of quantum physics, and therefore the action of these physical factors (alternating electric current, direct electric current, magnetic field, photo-stimulation and sound stimulation) could possible be, to some extent, congruent and coherent with project issues.

In order to change the state of consciousness and of its phenomenological structure analysis with the aforementioned instruments, this research will be carried out not only on healthy volunteers but on a special group of patients, i.e. patients with painful syndromes (especially chronic pain). The advantage of using this approach lies in the possibility to obtain two types of results: a) induction of ASC and their structural - phenomenological analysis; b) the effect on pain syndrome with its subjective measurement (special pain self-assessment scales) and recording vegetative components, electrophysiological (EEG) and fMRI.

Subsequently the data obtained can be interpreted in terms of quantum physics. The analysis of the phenomenological structure of consciousness (in healthy volunteers and in patients suffering from pain) depending on the type of used physical action would be a heuristic and creative insight of this research.

# 5 Advanced relativity, multidimensionality of consciousness and origin of life

All thoughts, theories and mathematics that the human mind can produce can be observed by the observer, which in Advanced Relativity (AR) has its origin in n-dimensional Hilbert space [36]. This means that the observer has the highest degree of complexity, which is then followed by mind in lower dimensional Hilbert spaces.

Advanced Relativity can be considered as an improvement and completion of Einstein Relativity with the help of quantum field theory (in particular, as regards the concept of creation/annihilation of elementary quanta). In AR the four-dimensional space of general relativity derives from a more fundamental three-dimensional quantum vacuum where time exists only as a measuring system of the numerical order of material changes. More precisely, the four dimensions of universal space can be seen as the effects, at an upper/explicate level, of a more fundamental three-dimensional timeless non-local quantum vacuum defined by reduction-state (RS) processes of creation/annihilation of particles/antiparticles (with opposite orientations of spins), corresponding to elementary fluctuations of the quantum vacuum energy density. The RS processes are described by a wave function at two components satisfying a time-symmetric extension of the Klein-Gordon quantum relativistic equation

$$
\begin{pmatrix} H & 0 \\ 0 & -H \end{pmatrix} C = 0 \tag{7}
$$

where

$$
H = \left( -\hbar^2 \partial^\mu \partial_\mu + \frac{V^2}{c^2}(\Delta\rho_{q\nu E})^2 \right) \tag{8}
$$

and

$$
\Delta\rho_{q\nu E} = \rho_{pE} - \rho_{q\nu E}, \tag{9}
$$

$$
\rho_{q\nu E} = \rho_{pE} - \frac{mc^2}{V}, \tag{10}
$$

where m is the mass of the object, V is its volume,

$$
\rho_{pE} = \frac{m_p c^2}{l_p^3} \tag{11}
$$

is the Planck energy density defining the ground-state of the 3D quantum vacuum (where $m_p$ is Planck mass, and $l_p$ is Planck length). The wave functions characterizing the RS processes of creation and annihilation are respectively

$$
\Psi_{Q,i}(t) = \int_{-\infty}^{+\infty} g_{Q,i}(\nu)e^{2i\pi\nu t}d\nu \tag{12}
$$

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$$\Phi_{Q,i}(t) = \int_{-\infty}^{+\infty} h_{Q,i}(\nu)e^{2i\pi\nu t}d\nu \tag{13}$$

Here $g_{Q,i}(\nu)$ and $h_{Q,i}(\nu)$ being the frequency modes characterizing the creation and destruction processes respectively. The occurring of the processes of creation/annihilation of quanta in space is determined by the frequency modes which appear in the wave function of the quantum vacuum through the quantum potential of the vacuum

$$Q_{Q,i}(t) = \frac{\hbar^2 c^2}{V^2(\Delta\rho_{q\nu E})^2} \left( \frac{\left(\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right)\left|\int_{-\infty}^{+\infty} g_{Q,i}(\nu)e^{2i\pi\nu t}d\nu\right|}{\left|\int_{-\infty}^{+\infty} g_{Q,i}(\nu)e^{2i\pi\nu t}d\nu\right|} - \frac{\left(\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right)\left|\int_{-\infty}^{+\infty} h_{Q,i}(\nu)e^{2i\pi\nu t}d\nu\right|}{\left|\int_{-\infty}^{+\infty} h_{Q,i}(\nu)e^{2i\pi\nu t}d\nu\right|} \right) \tag{14}$$

which makes the $3D$ quantum vacuum a fundamentally non-local manifold.

In AR, the $3D$ quantum vacuum consisting of an enormous amount of RS processes of creation/annihilation of particles-antiparticles with opposite orientations of spins can provide a unifying view of gravity, electromagnetic fields and quantum behaviour of matter as different aspects of the same fluctuations of the quantum vacuum energy density. In particular, as a consequence of the evolution of RS processes, spacetime is filled with virtual radiation of frequency

$$\omega = \frac{2\Delta\rho_{q\nu E}V}{\hbar n} \tag{15}$$

In the light of equation (9), each elementary fluctuation of the quantum vacuum energy density in a given volume produces an oscillation of space at a peculiar frequency. This means that each material object corresponds to oscillations of the $3D$ quantum vacuum given by equation (9).

The frequency (9) may be considered the origin of the electromagnetic effects of the $3D$ quantum vacuum in the sense that the electromagnetic field inside a cavity of perfectly reflecting can be seen as an expansion of infinite different modes of the fundamental $3D$ quantum vacuum where each mode corresponds to an independent oscillation defined by frequency (9) produced by a specific RS process of creation/annihilation of quanta in correspondence to elementary fluctuations of the $3D$ quantum vacuum [36]. This means that the spectral energy density for the zero-point fluctuations characterizing the

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electromagnetic properties of the quantum vacuum is

$$\rho(\Delta\rho_{q\nu E}) = \frac{4(\Delta\rho_{q\nu E})^3 V^3}{\hbar^2 \pi^2 n^3 c^3} \tag{16}$$

By starting from equations (15) and (16), in AR the electric and magnetic fields are two different kinds of polarization of the 3D quantum vacuum produced by the frequencies of the radiation associated with the motion of the virtual particles produced in the RS processes, namely by the elementary fluctuations of the quantum vacuum energy density. In particular, in the SED regime, the quantum vacuum fluctuations are random plane waves summed over all possible modes with each mode having the zero-point energy $\hbar\omega/2$, and thus the electric and magnetic fields may be expressed as [36]

$$\begin{aligned}
\vec{E}_\tau^{zp}(\vec{r}, t) &= \sum_{\lambda=1}^{2} \int d^3k (\Delta\rho_{q\nu E} V/n\pi^2)^{1/2} \hat{\varepsilon}(\vec{k}, \lambda) \\
&\times \cos\left[\vec{k}, \vec{r} - \frac{2\Delta\rho_{q\nu E} V}{\hbar n} t - \theta(\vec{k}, \lambda)\right]
\end{aligned} \tag{17}$$

$$\begin{aligned}
\vec{B}^{zp}(\vec{r}, t) &= \sum_{\lambda=1}^{2} \int d^3k (\Delta\rho_{q\nu E} V/n\pi^2)^{1/2} \left[\hat{k} \times \hat{\varepsilon}(\vec{k}, \lambda)\right] \\
&\times \cos\left[\vec{k}, \vec{r} - \frac{2\Delta\rho_{q\nu E} V}{\hbar n} t - \theta(\vec{k}, \lambda)\right]
\end{aligned} \tag{18}$$

According to relations (17) and (18), the electromagnetic radiations are expressed as expansions of plane waves, where the sum is over two polarization states, $\hat{\varepsilon}$ is a unit vector, $\vec{k}$ is the polarization vector such that $|\vec{k}| = \omega/c$ and $\theta(\vec{k}, \lambda)$ is a random variable uniformly distributed in the interval $(0, 2\pi)$ and independently for each wave vector $\vec{k}$ and polarization index $\lambda$. The magnetic field can be seen as the polarization of space in $\hat{k} \times \hat{\varepsilon}(\vec{k}, \lambda)$; the electric field is the polarization of space in $\hat{\varepsilon}(\vec{k}, \lambda)$.

In AR life on the molecular level of $3D$ dimensionality has origin in $nD$ consciousness. Evolution of life is encoded in $4D$ and more dimensional Hilbert spaces of higher information density and is communicated to the $3D$ ordinary life dimensionality via bio-photons. It is already confirmed bio-photons are transporting information between cells. In this perspective, the evolution of life is an ongoing process running in the entire universe [36, 37].

In modern quantum biophysics much attention is devoted to the Vedanta explication of universal consciousness. Even Nobel Prize Laureate Erwin Schrodinger, who had a life-long interest in the Vedanta philosophy, which to a marked degree improved his book "What is Life?" [38] about the possibility that individual consciousness is only a manifestation of a unitary consciousness pervading the universe, recognized that: "Vedanta teaches that consciousness is singular, all happenings are played out in one universal consciousness and there is no multiplicity of selves".

# 6  Summary

Evolution of life has its informational basis in higher dimensional Hilbert spaces which also represent the origin of consciousness and mind. The idea of neurology that mind has its origin in neuronal activity of the brain, which is three-dimensional, is here improved with the model that the mind states exist in higher dimensional Hilbert spaces. Mind is multidimensional and has the ability of ASC phenomena.

Advanced Relativity is the unified model of the universe, life, mind, and consciousness where all phenomena are guided by consciousness via lower dimensional Hilbert spaces. In this model, time is the numerical order of changes and exists only in $3D$ reality. $4D$ and more dimensional Hilbert spaces realities are timeless (phenomena there do not have numerical order and are immediate) which gives new vision on the origin of life, ASC and the timeless nature of consciousness itself.

The possibility of quantum information processes in MTs of brain neurons is also investigated. Much attention is devoted to the quantum-statistical properties of protein microtubules [39]. It is shown that fluctuation function of MTs $S_z(t)$ has the tendency towards oscillations but exact periodicity of $Sz(t)$ oscillations is violated. It should be noted that exact periodicity of $S_z(t)$ oscillations takes place when one of the dipole moment matrix transition elements between neighbouring biomolecular levels tends to zero. In this situation fluctuation function determines number of generated biophotons in protein microtubules and is connected with oscillations of EEG signal. Moreover, entanglement and non-local correlations exist between biophotons and tubulin structures of different MTs of brain neurons, situated at distances much larger than their own dimensions.

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